form of the craters, as I might call them, of the barometric depressions, and their steepness in different directions.

The following note has some connection with this inquiry, and I beg you, if you think it suitable, to give it a place in your esteemed journal :—

In 1874 I proposed to lay, as well as it can be done, a plane or planes, having such a slope as would represent the barometric height at some two distant places, and to indicate (in geodetic terms) the fall and strike, or the inclination on the horizon and the azimuth of the projection of the perpendicular on such a plane, and I still recommend it. In the Netherlands, where my area is small (see Jour. Scot. Met. Soc., iv. 25) it is always easy to find such a plane, and of course its perpendicular. Now I have inquired whether the projection of that perpendicular moved round the horizon generally in a direct way (with the sun) in the same manner as M. Dove has found that the direction of the wind does, and which I demonstrated in *Pogg. Ann.*, lxviii. 417, 553, to be the case thirteen times per annum in our latitude.

On examination I find that in 1874 and 1875 the projection has gone round the horizon in a direct way ten times more than the opposite way ; further, that it often goes back when the direction of the projection lies to the south-east, but that when it has veered to be to the north-west it veers forward surely and quickly enough in a direct way to the east, which is in accordance with the fact that when we have a depression over Ireland or Scotland it then moves in the direction of Norway and Finland. I don't think it superfluous to call the attention of others to this research, and I propose to calculate the results for other years in this respect, which is easily done by means of the Netherlands' *Annuaires*, and thus find thrice a day the direction and size of the steepest gradient.

Utrecht, December 23, 1876 BUYS BALLOT

Mind and Matter

THE problem, "How consciousness stands related to the material organism," has been attempted to be solved by Mr. Duncan, under the head of "Mind and Matter" (NATURE, vol. xv., p. 78). Now that a more exact scientific examination has reconciled so many differences on this question, a return to the old *à priori* method of mere logic is still perfectly legitimate, provided the logic is sound.

Admitting that consciousness is *related* to matter, and without contending, for the present, that it may not be a *state* of matter (under certain restrictions of the term), I will content myself with pointing out what seem to be fallacies in this "solution." "It is as easy," says Mr. Duncan, "to predicate subjectivity (susceptibility to consciousness) of one entity called matter as of another entity called soul or spirit. It is no more difficult to conceive of matter being subjective than of spirit being subjective." Let us see if this is or is not petitio principii. It was the difficulty, real or apparent, of ascribing certain attributes (mental) to matter, that demanded the supposition of some support other than material. So that when we say that spirit is alone susceptible to consciousness, we merely express that matter is not thus susceptible. Therefore, to affirm that the one may be as susceptible to consciousness as the other is to assume, *in limine*, that matter may be susceptible to consciousness, the very probability which has to be established.

Mr. Duncan next asserts that "How energy is related to matter in all its forms, is no less mysterious than how subjectivity may be a property of matter." Now every opponent of materialism admits that how energy is *related* to matter is a mystery, and avows that he cannot conceive of consciousness as a *property* of matter ; but the difficulty of understanding the *how*, even if we grant it equal in both cases, cannot establish any parity of probability as to the facts ; for while we know as a fact that energy is *related* to matter, we do not know as a fact that subjectivity (susceptibility to consciousness) is a *property* of matter. And even if we put the argument more exactly, and affirm that we know that subjectivity, like energy, is *related* to matter, still nothing in point is gained, seeing that while we know *all* matter in relation to energy, it is only a certain form of matter (the human) which we *know* to be related to subjectivity ; for if we surmise this of a dog, we cannot *know* it till he tell us.

The next position, "Energy may be divided. Why not subjectivity?" would seem to demand nothing less than absolute proof, since subjectivity, or the state of the Ego, appears indivisible in virtue of its essential unity. Yet no support is advanced except the foregoing assertion, which we have seen is a mere assumption on the side of materialism, and which we shall next see contains an admission all but fatal to the cause it advocates. When Mr. Duncan says, "How energy is related to matter is no less mysterious than how subjectivity may be a property of matter," he admits that we cannot understand either, while he believes the first because it is a fact. But why should we believe the last? Because we cannot understand it, and because it is not a fact? Will he admit that we have advanced any proof of an oyster being an astronomer, when we have affirmed that this would be no more mysterious than the relation of energy to matter? Yet his three remaining arguments go on this ground : they assume that the probability of subjectivity being a property of matter equals the fact of energy being related to matter.

Rugby J. L. TUPPER

Solar Physics at the Present Time

AT the conclusion of his letter of the 1st inst. (NATURE, vol. xv. p. 196), Sir G. B. Airy alludes to a paper of mine as being cited by me (in my last letter to NATURE) as being "in the 'Philosophical Transactions.'"

The paper referred to *ought*, with little doubt, to have appeared there, but it did not, and I was most careful to avoid implying that it had ; my words being with regard to it (see your pages 157 and 158) :—

1st, "which I had the honour of communicating to the Royal Society of London *six* years ago ;" and

2nd, "that paper of six years ago, and still in the hands of the Royal Society ;"

nor is there any mention of the "Philosophical Transactions" throughout.

PIAZZI SMYTH,
Edinburgh, January 5 Astronomer Royal for Scotland

Towering of Birds

SNIPE frequently tower—also pigeons. I saw a mallard that flew nearly half a mile, towered, and, fell dead. Teal also tower, but their towering is different to the ordinary, as they are as often alive as dead when they fall. I have also remarked this in widgeons, and once in a partridge. In the latter case birds fell right and left, the second a towerer. It was in heavy turnips that had been planted when mangel had missed. The towerer fell on an isolated mangel ; when picked up, he was at least ten yards from the mangel and still alive. Some years ago there was a discussion on this subject in *Land and Water* or the *Field*, and I think it was shown it was due to pulmonary hæmorrhage. At least I was quite aware of the cause, and that head or spine injuries had nothing to do with it.

Ovoca, Ireland G. H. KINAHAN

Rooks Building at Christmas

ON Christmas morning I saw a few rooks engaged in building in a clump of elms near my house. Four nests are now in progress, though the gale of December 30 made the rooks desist from their work. During the ten years (about) that I have watched their proceedings, I think I have never seen these birds begin building till February.

I may add that our well-watered lands and woods are being visited with wild duck, teal, peewits, and gulls in great numbers. C. M. INGLEBY

Valentines, Ilford, Essex

Are We Drying Up?

THE above question has been asked in the columns of NATURE. As a small contribution towards an answer, it may be stated that at this place the two last years, 1875 and 1876, have been the two wettest in a series of twenty-four years.

In 1875, the rainfall was 44·05 inches.
In 1876 ,, ,, 42·42 ,,
The average of twenty-four years has been 33·11 inches.

Clifton, January 7 GEORGE F. BURDER

Radiant Points of Shooting Stars

IN December, from observations of 163 shooting stars seen in 20½ hours' watching, chiefly in the evenings, I amply confirmed several of the positions of radiant points as given in my note (NATURE, vol. xv., p. 158), and observed that several of the showers there mentioned were actively continued. The centres, as I gave them, of two of these require revision, as the additional meteors seen in December indicate the radiants with

greater precision than the few I had noted in November. The new radiant in Sextans, I now deduce at R.A. 148°, Decl. 2° N., and that at τ Leonis, as near Crater R.A. 165°, Decl. 6° S. The meteors from these new showers are very rapid and white, usually leaving bright streaks for 2 or 3 secs. in their path.

Ashley Down, Bristol, January 2 W. F. DENNING

ALEXANDER BAIN

IT is with much regret that we announce the death of Mr. Alexander Bain, which took place at Glasgow on January 2. To many of our readers his name is perhaps unknown, and yet the inventions of Mr. Bain, made when telegraphy was in its infancy, were of the very highest importance. They were perhaps made too soon. Mr. Bain himself never reaped the benefit of them, and would have died in great poverty had it not been for a pension of 80*l.* a year obtained for him from Mr. Gladstone chiefly through the exertions of Mr. C. W. Siemens, Sir William Thomson, and the Society of Telegraph Engineers.

One of the most important services of Mr. Bain to telegraphy was the reinvention of the method of making use of "bodies of natural waters" "to complete the electric circuit by laying a single insulated wire between the given stations, having at each end a metallic brush immersed in the water." In 1838 Steinheil discovered the use of the earth for completing a circuit instead of a return wire, but does not appear to have taken steps to bring his discovery into notice, or to remove the prejudices with which a discovery so startling would naturally be met. Mr. Bain seems to have established the principle for himself, and he published it in a patent of 1841, by Wright and Bain, for "Improvements in applying electricity to control railway engines and carriages, to mark time, to give signals, and to print intelligence at different places." It is impossible to say how large a part of the completeness of our present telegraphic system, particularly of our submarine telegraphic system, is due to this great discovery of Steinheil and Bain.

An early invention by Mr. Bain, was that of the electro-chemical telegraph. This was patented in 1846. Paper chemically prepared is drawn under a metallic style which rubs upon it. As long as there is no current passing in the line the paper comes away from the style unmarked, but each signal sent through the line passes by the style to the prepared paper and leaves a mark. Combinations of dots and dashes, as in the Morse system, formed Mr. Bain's alphabet.

At first the signals were sent by hand by a simple contact key, but Mr. Bain soon found his system capable of receiving signals at far higher speed than that of the fastest hand sending. He was thus led to the invention of automatic methods of transmitting signals of which one is the basis of the most important method at present in use. A slip of paper is perforated with holes arranged in groups, forming the letters required in accordance with the code of signals. This slip is passed between a metallic roller and a contact point. As long as the contact point is separated from the roller by the paper slip, no current passes in the line. But when one of the perforated holes comes under the contact point, the point falls in and makes contact with the metallic roller. The circuit is thus closed, and a signal is sent.

This apparatus was tried before Committees of the Institute and of the Legislative Assembly at Paris. Through a line between Paris and Lille, a message of 282 words was sent. The time taken was fifty-two seconds! The fastest automatic receiving by mechanical instruments of the most refined modern construction, such, for example, as the instruments of Wheatstone, does not commonly reach 100 words per minute. We hear from Sir William Thomson, in his recent address to the British Association, that he *saw* in America "Edison's Automatic Telegraph delivering 1,057 words in 57 seconds—this done by the electro-chemical method of Bain." That Mr. Bain's method was not received in England cannot but be regarded as a great misfortune.

These were, perhaps, Mr. Bain's principal inventions, but there are others of such importance that they well deserve notice. Several of his patents relate to the keeping of time by clocks controlled or driven electrically by a standard clock. Jones' system, now so largely used in England, is based upon the system of Bain. He invented the earth battery in 1843, or rather reinvented it, as Gauss and Steinheil had previously obtained a current, after the discovery by Steinheil of using the earth for a return wire, making one of the earth plates of zinc and the other of copper. In 1844 he patented ingenious apparatus for registering the progress of ships and for taking soundings. Vanes caused to rotate by the motion of the "log" or "sounding fly," through the water were employed, and an electrical method of observing the result on board was employed. The same patent describes apparatus for giving warning when the temperature of the hold of a ship rises above a certain point. An electric circuit was employed, which was closed by the expansion by heat of mercury contained in a tube. The current passing in the circuit traversed coils which formed an electro-magnet. A pointer or alarm connected with the magnet gave the required warning. This method is now very commonly employed for fire alarms; and modifications of it have been proposed for giving warning of over-heating in the bearings of machinery.

He had also an electric method of playing a keyed instrument at a distance on more than one organ or piano at a time; and he applied his perforated paper to the automatic playing of a wind instrument, such as an organ. For this purpose the paper, properly punched, was drawn between the openings of the wind chest and the openings of the notes to be played upon. Whenever and as long as there was a punched hole of the paper between the wind chest and the pipe the note of the pipe sounded. When there was a blank space between the wind chest and pipe the pipe was silent.

In his later years Mr. Bain's inventions have been inconsiderable. Some years ago he was stricken down with paralysis. He died at the age of sixty-six, on the second day of this year, in the Home for Incurables, Broomhill, near Glasgow.

PHOTOGRAPHS OF THE SPECTRA OF VENUS AND α LYRÆ

SINCE the spring of 1872 I have been making photographs of the spectra of the stars, planets, and moon, and particularly among the stars, of α Lyræ and α Aquilæ, with my 28-inch reflector and 12-inch refractor. In the photograph of α Lyræ, bands or broad lines are visible in the violet and ultra-violet region, unlike anything in the solar spectrum. The research is difficult, and consumes time, because long exposures are necessary to impress the sensitive plate, and the atmosphere is rarely in the best condition. The image of a star or planet must be kept motionless for from ten to twenty minutes, and hence the driving-clock of the telescope is severely taxed.

During last summer I obtained some good results, and in October took photographs of the spectrum of Venus, which show a large number of lines. I am now studying these pictures, and have submitted them to the inspection of several of my scientific friends, among others, Professors Barker Langley, Morton, and Silliman. There seems to be in the case of Venus a weakening of the spectrum towards H and above that line of the same character as that I have photographically observed to take place in the spectrum of the sun near sunset.

New York, December, 1876 HENRY DRAPER